



# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P-26-485-PCT		<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/EP2005/050484		International filing date (day/month/year) 04.02.2005	Priority date (day/month/year) 13.02.2004	
International Patent Classification (IPC) or national classification and IPC INV. H03L7/10 H03L7/099 H03L7/095				
Applicant ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE (EPFL)				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 1 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  12.12.2005		Date of completion of this report  16.05.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer  Kahn, K-D  Telephone No. +49 89 2399-2253 		

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2005/050484

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3(a) and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4(a))
    - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-13 as originally filed

**Claims, Numbers**

5-18 as originally filed

1-4 received on 16.12.2005 with letter of 12.12.2005

**Drawings, Sheets**

1/6-6/6 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	2 - 18
	No: Claims	1
Inventive step (IS)	Yes: Claims	
	No: Claims	1 - 18
Industrial applicability (IA)	Yes: Claims	1 - 18
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/EP2005/050484

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1. Reference is made to document D1:  
D1: US 2003/146794 A1 (YAMAGISHI AKIHIRO ET AL) 7 August 2003.
2. The amendments filed with the letter dated 12.12.2005 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.  
The amendments concerned in claim 1 are the following:
  - "digitally blocking" each tuned element;
  - blocking in "the flat maximum or minimum region" and
  - "decreasing" the gain of said elements.These features are not explicitly mentioned nor are they available from the application as originally filed.
3. Disregarding the added subject-matter mentioned above under point 1, the present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.  
Document D1 discloses (the references in parentheses applying to this document):
  - a method for self calibrating a PLL,  
wherein
    - the VCO operating mode is switched
      - in a first frequency tuning operation to a high gain mode (see paragraph 38), and
      - after locking to the appropriate frequency (see paragraph 38) to a zero-gain mode (open loop, see paragraph 39) such that the frequency of the VCO remains unchanged (see paragraph 45).In D1 the loop filter 130 is isolated from the charge pump 120 during the open loop mode (see paragraph 39) and the gain of the VCO with respect to the charge pump is reduced or set near zero, see formulas (1) and (2), and therefore also noise sensitivity is reduced.

4. In view of the prior state of the art given by documents D1 - D5, it appears that the independent claim 10 and the dependent claims 2 - 9 and 11 - 18 do not contain any additional features which could form subject matter involving an inventive step. Consequently, the claims do not fulfil the requirements of Article 33 (3) PCT.

**Re Item VII**

**Certain defects in the international application**

1. The claims are not in the correct two-part form in accordance with Rule 6.3(b) PCT.
2. The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT, there being no reference to the prior art document D1.

**Re Item VIII**

**Certain observations on the international application**

1. The application does not meet the requirements of Article 6 PCT because claim 1 is not clear:
  - it is not clear, to which circuits or parts the words "comprising" (line 1) and "including" (line 3) refer to; the same applies to "which output signal" (line 3), where it is unclear, if the tuned elements or the VCO is meant;
  - the following terms/expressions merely define a result to be achieved without defining any of the method steps, which are necessary to arrive at that desired result:
    - in line 6, the expression: "using a linearised ... curve" leaves it unclear, how the linearisation is achieved;
    - the word "enabling" in line 7 renders it unclear, how the wide locking range of the loop is achieved;
    - the word "automatically" in line 9 renders it unclear, when and at what condition the said switching is performed;
  - in line 6, the comma after switched renders it unclear if the VCO operating mode is switched "into" a first tuning operation or "during" or "after" the first tuning operation;

- in line 6 it appears that it is not the "VCO operating mode", which is switched, but the whole PLL is switched, because locking can only occur in closed loop operation;
  - in line 8, it is unclear, what "the appropriate" frequency is;
  - the (added) expression of "digitally blocking" "a tuned element" is unclear, because the expression "blocking a tuned element" renders it unclear, what actually is done with the said element;
  - throughout the claim it is unclear, where a certain, single VCO tuned element is meant or where the plurality of tuned elements are meant;
2. Any independent claim must contain all the technical features essential to the invention in order to meet the requirement of Article 6 taken in combination with Rule 6 PCT. Furthermore, in order that the apparatus claim 10 and the method claim 1 satisfy Rule 13.1 PCT regarding unity of invention, each apparatus feature of claim 10 should correlate with a method feature of claim 1 so that it is clear that the PLL is specifically designed to perform the method of claim 1.
3. The application does not meet the requirements of Article 6 PCT because the application is not clear:
- the description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT, because a loop including a ring oscillator type is not contained in the invention defined in the claims;
  - the last word on page 2 cannot be understood in the context;
  - in figure 5 no reference sign "515" can be identified as stated in line 15 on page 10;
  - the time axis of figure 9 cannot be understood;
  - figures 10 and 11 are not described at all.

## CLAIMS

1. Method for analogue self calibrating of a phase locked loop (PLL) circuit comprising a phase frequency detector (PFD), a charge pump (CP), a loop filter (LPF), a voltage controlled oscillator (VCO), including a plurality of VCO tuned elements, which output signal is compared with a reference signal frequency ( $F_{ref}$ ) entering in the phase frequency detector (PFD) characterized in that, the voltage controlled oscillator (VCO) operating mode, using a linearized frequency versus voltage curve, is switched, in a first frequency tuning operation enabling a wide locking range, to a linear high gain (LHG) mode, after locking to the appropriate frequency with the said first tuning operation, said voltage controlled oscillator (VCO) operating mode is automatically switched to a zero-gain (ZG) mode by **digitally blocking each VCO tuned elements in the flat maximum region or the flat minimum region of the characteristic of said element in such way that while keeping the frequency of said voltage controlled oscillator (VCO) remains unchanged and the gain of said element is significantly decreased.**
2. Method according to claim 1 characterized in that, after said zero-gain (ZG) mode, said voltage controlled oscillator (VCO) operating mode is switched to a low gain (LG) mode enabling a fine tuning of the frequency by the phase locked loop (PLL) for compensating small residual frequency errors and temperature variations.
3. Method according to claim 1 characterized in that, the voltage controlled oscillator (VCO) frequency versus voltage operating curve linearization comprises following steps:
  - breaking the required linear frequency versus voltage curve  $FV$  into several sections  $fV$  over either constant or non constant voltage intervals;
  - selecting for each section  $fV$  a corresponding VCO tuned element giving the same frequency variation over said section  $fV$ ;
  - submitting each VCO tuned element to a specific voltage, deduced from the loop filter (LPF) output tuning voltage, in such way that said VCO tuned element is activated in the same voltage interval as its corresponding section  $fV$ .
4. Method according to claim 1 characterized in that the linearization of the voltage controlled oscillator (VCO) frequency versus voltage operating curve is performed during the linear-high gain (LHG) mode.